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ABSTRACT

This booklet is intended to help mainstreamed mentally retarded, emotionally disturbed, or learning disabled high school students acquire a basic understanding of the responsibilities and working conditions of metal product assemblers and to practice basic math skills necessary in the occupation. The first section provides a brief introduction to the occupation by focusing upon those job tasks of a metal product assembler with which the student is likely to be familiar. The next two sections deal with the work environment of the typical metal product assembler and the training, education, and experience needed for the occupation. Exercises addressing basic math skills used by metal product assemblers are provided. Various suggestions are listed for students interested in further exploring the occupation of metal product assembler. A glossary and answer sheet conclude the booklet. (YLB)

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MATH on the job

Metal Product Assembler

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MATH ON THE JOB:

METAL PRODUCT ASSEMBLER

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MATH on the job

Metal Product Assembler

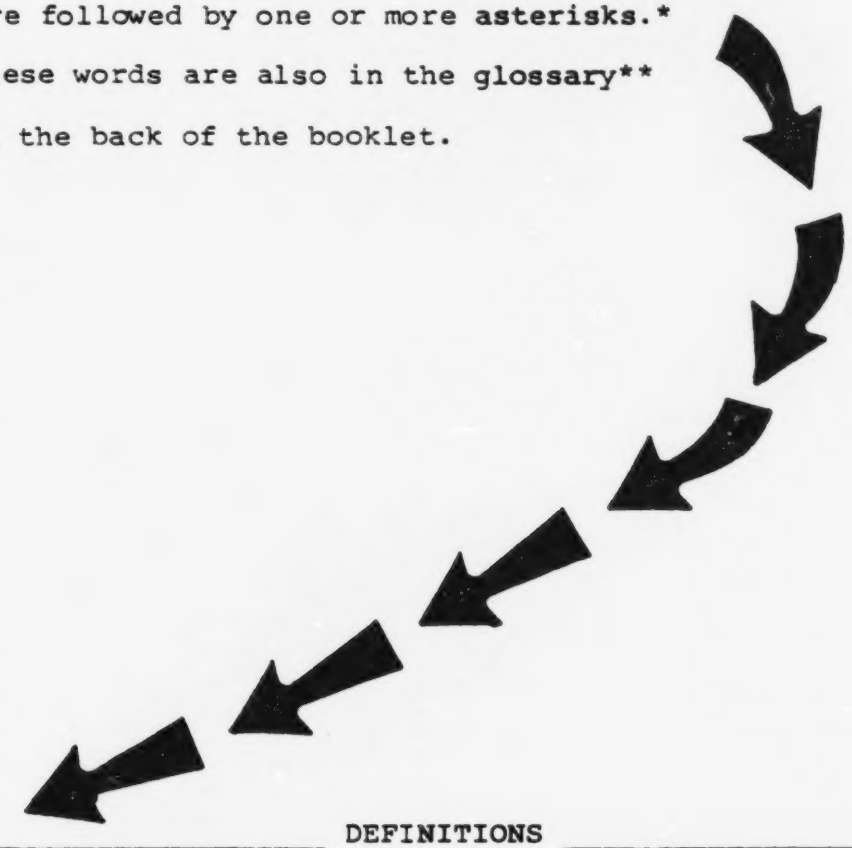
In this booklet, you can--

- find out what a metal product assembler does
- see how a metal product assembler uses math
- get a chance to use math as a metal product assembler
- find out the types of things a metal product assembler needs to know
- find out what courses, training, and experience you need to become a metal product assembler

SPECIAL WORDS USED IN THIS BOOKLET

Workers in many jobs use special words or special meanings for words. Learning these words helps you to learn about a job.

You will find some of these special words in this booklet. When these words, and some hard words, are used for the first time, they are followed by one or more **asterisks.*** These words are also in the **glossary**** at the back of the booklet.



DEFINITIONS

*An asterisk (*) is a symbol that tells you to look at the bottom of the page for the meaning, or definition, of the word.

**A glossary is a list of words with their meanings.

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HAVE YOU EVER...

- put together a model airplane, boat, or automobile?
- helped another person assemble a swing set?
- watched, or helped, someone assemble a piece of furniture such as a bed, dresser, table, or shelves?

If you have, then you have some idea about the work of a metal product assembler. This booklet will help you learn about the work of a metal product assembler and how math is important to do the job.

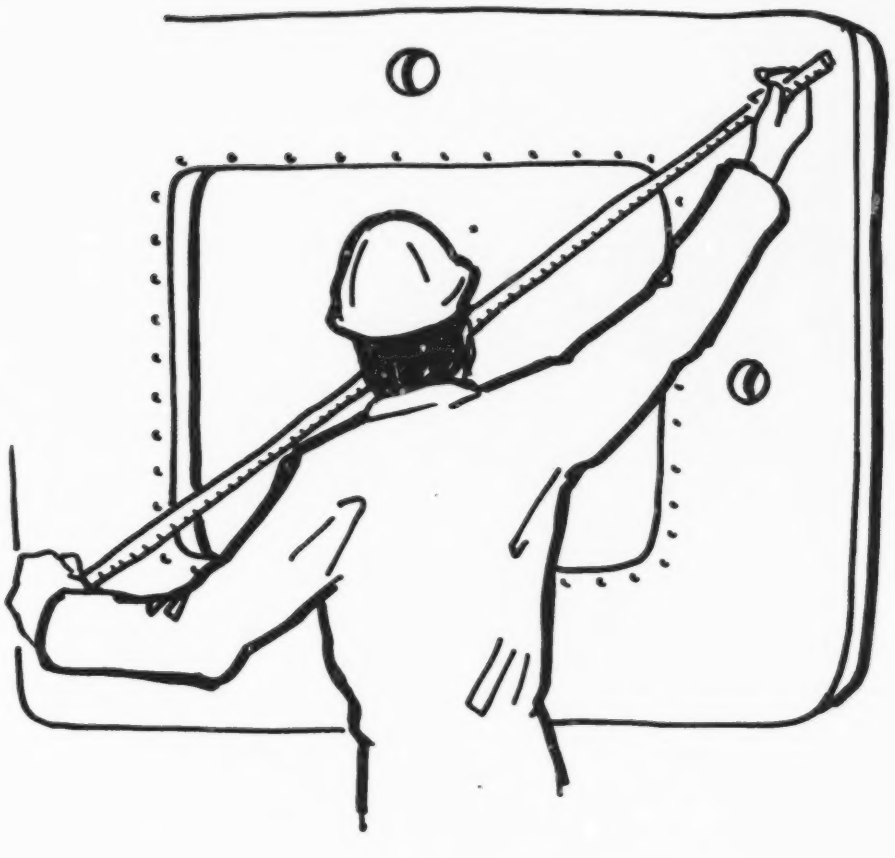
WHAT DOES A METAL PRODUCT ASSEMBLER DO?

A metal product assembler puts together metal parts to make a product such as a stove, automobile, or clothes dryer. How does a metal product assembler do this? As a metal product assembler, you--

- work on a product or assembly line as part of a team
- perform your work while the part or product moves past your work station on a conveyor belt
- usually perform a single assembly task such as putting a nut on a bolt or tightening bolts

A metal product assembler uses math on the job every day. As a metal product assembler, you--

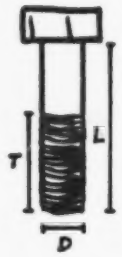
- count, add, subtract, multiply, and divide
- use whole numbers, fractions, and decimals
- use measuring instruments such as gauges and rulers to take measurements



A metal product assembler uses math to measure metal fasteners.

EXAMPLE

Metal product assembers use metal fasteners to join pieces of metal. To find the correct fastener for a job, a metal product assembler must measure the fasteners. A metal product assembler uses a metric rule to measure the thread (T), the length (L), and the diameter (D) of a fastener to the nearest millimeter. Look at the fastener below. What are the thread (T), the length (L), and the diameter (D) measurements of the fastener?



To find these measurements, use your metric ruler and measure the lines marked T, L, and D. Your answers should be to the nearest millimeter. In this example, the measurements are--

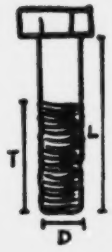
T = 14 mm
L = 24 mm
D = 6 mm

NOW YOU TRY IT

Practice Exercise A

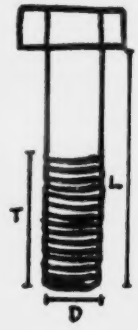
Use a metric ruler to measure the thread (T), the length (L), and the diameter (D) of each fastener below. Your measurement should be to the nearest millimeter.

1.



2.

3.



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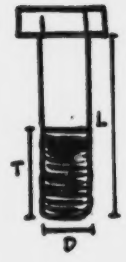


A metal product assembler uses math to work with equipment.

EXAMPLE

The distance from the top of one thread to the top of the next thread on a fastener is called the pitch of a fastener.

In order to use a fastener, a metal product assembler must first drill a hole with a tap drill. The diameter of the hole must be slightly smaller than the fastener so the threads of the fastener will hold in the metal. What should the diameter of the tap drill be if a fastener has a diameter of 3 mm and a pitch of 1 mm?

To find the correct diameter for a tap drill, subtract the pitch of the fastener (1 mm) from the diameter of the fastener (3 mm):

3 mm - 1 mm = 2 mm

The diameter of the tap drill should be 2 mm.

NOW YOU TRY IT

Practice Exercise B

Find the diameter of the tap drill for each fastener below. The first one is done for you.

Remember: Diameter of fastener - Pitch of fastener = Diameter of tap drill

	Diameter of Fastener (mm)	Pitch of Fastener (mm)	Diameter of Tap Drill (mm)
	3	0.5	2.5
5.	4	1.25	?
6.	5	0.8	?
7.	6	3.0	?
8.	8	2.0	?
9.	10	3.5	?
10.	12	1.0	?

A metal product assmebler uses math to keep track of production.

EXAMPLE

A metal product assembler works on an assembly line. Assemblers make such products as toasters, stoves, and automobiles. To keep track of production, a production chart is used. The chart below is a sample production chart, showing how many cases of toasters can be filled in a minute, an hour, a day, and a week.

	Assembly line: Toasters
Toasters per minute	24
Toasters per case	6
Cases per minute	4 (24 ÷ 6)
Cases per hour (60 min.)	240 (60 x 4)
Cases per day (8 hours)	1,920 (8 x 240)
Cases per week (5 days)	9,600 (5 x 1,920)

How many cases can be filled in 3 minutes?

To find the amount, multiply the number of cases per minute (from the chart) by the number of minutes:

4 cases per minute x 3 minutes = 12 cases

In 3 minutes, 12 cases can be filled.

NOW YOU TRY IT

Practice Exercise C

For questions 11-18, use the production chart from the example above to find the number of cases or amount of time worked.

	Time Worked	No. of Cases
11.	27 minutes	?
12.	45 minutes	?
13.	7 hours	?
14.	7 days	?
15.	9 weeks	?
16.	?? (minutes)	16
17.	?? (minutes)	72
18.	?? (hours)	9,600

BEST COPY AVAILABLE

A metal product assembler uses math to figure out gross income.

EXAMPLE

Some metal product assemblers are paid by the number of metal products on which they work. This is called piece work. These workers usually keep a record of the number of pieces worked on each day of the week:

M	T	W	Th	F
52	49	51	50	52

To find their gross (before taxes) income, they can multiply the total number of pieces worked on by the rate per piece. If the rate per piece is $0.79, what was the assembler's gross income for that week? To find this amount, first total the number of pieces worked on by the metal product assembler:

$$52 + 49 + 51 + 50 + 52 = 254$$

Then multiply the total number of pieces by the rate per piece.

$$254 \times \$0.79 = \$200.66$$

The metal product assembler's gross income is $200.66

NOW YOU TRY IT

Practice Exercise D

Find the gross income for each metal product assembler listed below. The first one is done for you.

	Employee Name	Pieces Worked On M	T	W	Th	F	Total Pieces	Rate Per Piece	Gross Income
	Axton,T.	58	72	69	63	75	337	$ .34	$114.58
19.	Baxter,S.	120	119	121	117	118	?	$ .26	?
20.	Che,R.	69	74	89	93	96	?	$ .57	?
21.	Dix,M.	28	35	33	41	67	?	$ .98	?
22.	Eden,S.	134	149	147	139	140	?	$ .75	?
23.	Fife,B.	98	101	95	111	105	?	$ .36	?
24.	Gogh,V.	20	21	20	22	23	?	$ .79	?

WHERE DOES A METAL PRODUCT ASSEMBLER WORK?

As a metal product assembler, you could work in many different types of industries. You could work in a factory which makes--

- airplanes
- automobiles
- stoves
- radios and televisions
- clothes dryers

You will work with other metal product assemblers as a team to make a finished product. A metal product will move past your work station on a conveyor belt. You will perform a single assembly task such as tightening a bolt. The part will move on to the next assembler, who will perform a different task. When all the assemblers have completed their individual tasks, the product will be finished.

A metal product assembler uses special types of equipment to perform the work. As a metal product assembler, you use--

- hand tools such as wrenches, screwdrivers, clamps, and files
- power driven hand tools such as drills, grinders, and power wrenches
- power driven machinery such as drill presses, punch presses, and fastening machines
- welding machinery such as spot welders and welding presses

IF YOU ARE INTERESTED IN

THE WORK OF A METAL PRODUCT ASSEMBLER

AND WOULD LIKE TO KNOW MORE,

READ ON

WHAT TRAINING, EDUCATION, AND EXPERIENCE DO YOU NEED TO BECOME A METAL PRODUCT ASSEMBLER?

There are no special educational requirements to be a metal product assembler. However, you should be a high school graduate.

To be a metal product assembler, you will need to know how to--

- use specialized hand tools
- operate machine tools
- use measuring instruments
- use **shop mathematics***

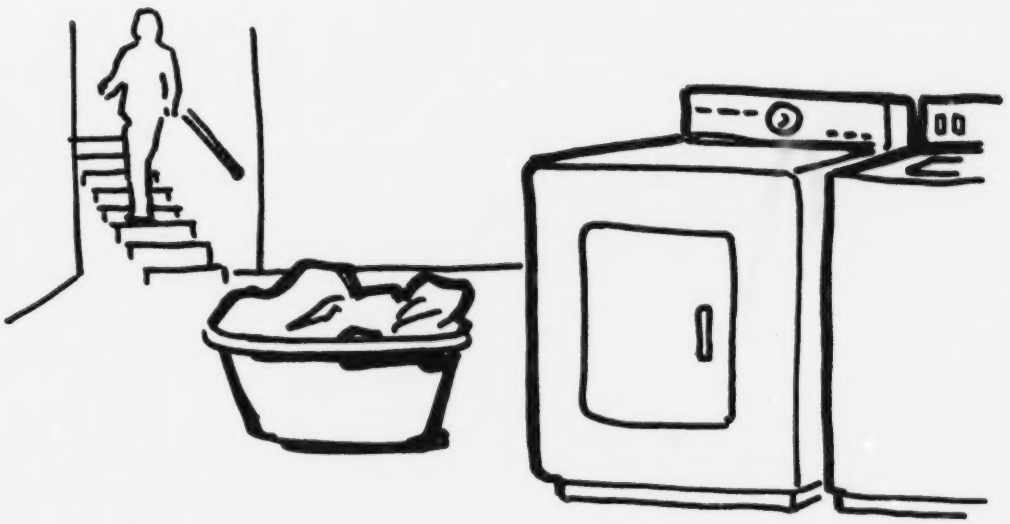
The best way to learn these things is to take courses in mechanical drawing, industrial arts, and shop mathematics at your high school. You may also want to take courses such as machine shop at your high school or vocational education center.

DEFINITIONS

*Shop mathematics are the types of calculations typically done in a machine shop.

As an assembly worker, you will learn most of your skills on the job. An experienced assembly worker will show you what to do. Training will take as little as a few hours or, at most, a few weeks.

Taking every chance to learn new skills and tasks will help you do a better job. Good math skills will also help you perform your work as a metal product assembler.

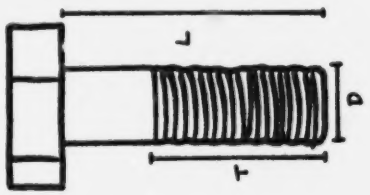


DO YOU WANT TO DO MORE METAL PRODUCT ASSEMBLER'S MATH?

Practice Exercise E

Use a metric ruler to measure the thread (T), the length (L), and the diameter (D) of each fastener below. Your measurements should be to the nearest millimeter.

25.



26.

27.

28.

Practice Exercise F

Find the diameter of the tap drill for each fastener listed below. The first one is done for you.

Remember: Diameter of fastener - Pitch of fastener = Diameter of tap drill

	Diameter of Fastener (mm)	Pitch of Fastener (mm)	Diameter of Tap Drill (mm)
	8	1.75	62.5
29.	10	2.5	?
30.	12	0.7	?
31.	16	3.0	?
32.	20	3.25	?
33.	24	3.5	?
34.	30	3.5	?
35.	36	3.75	?

Practice Exercise G

For questions 36-42, use the production chart below to find the number of cases or amount of time worked.

	Assembly line: Toasters
Toasters per minute	24
Toasters per case	6
Cases per minute	4 (24 : 6)
Cases per hour (60 min.)	240 (60 x 4)
Cases per day (8 hours)	1,920 (8 x 240)
Cases per week (5 days)	9,600 (5 x 1,920)

	Time Worked	No. of Cases
36.	59 minutes	?
37.	7.5 hours	?
38.	4.75 days	?
39.	52 weeks	?
40.	?? (minutes)	236
41.	?? (hours)	19,200
42.	?? (weeks)	19,200

Practice Exercise H

Find the gross income for each metal product assembler below.

Remember: Pieces worked on x Rate per piece = Gross income

	Employee Name	Pieces Worked On M	T	W	Th	F	Total Pieces	Rate Per Piece	Gross Income
43.	Bates,S.	19	21	16	18	17	?	$ 1.09	?
44.	Che,R.	133	140	139	145	141	?	$ .34	?
45.	Dix,M.	149	156	161	164	170	?	$ .36	?
46.	Eden,S.	176	182	185	187	200	?	$ .57	?
47.	Long,L.	213	222	245	239	240	?	$ .65	?

DO YOU WANT TO EXPLORE SOME MORE?

1. Talk to people who work as assemblers in a shop or factory. Ask them what they like and dislike about their work. Find out how assemblers use math on the job.

2. Visit a shop or factory that employs assemblers. Observe the assemblers on the job. Do the assemblers work by themselves or as a team on an assembly line? How many different assembly jobs can be you identify? Describe the different assembly jobs.

3. Assemblers often do routine, repetitive work. They perform the same assembly task over and over. Would you mind doing this type of work? Why or why not?

4. Do you like to put things together? Do you like to work with your hands? Do you like working with tools? Are you able to work quickly and accurately? If you like to do these things, you would make a good assembler.

5. Are you interested in other jobs which are similar to that of the metal product assembler?

   - Electrical equipment assemblers assemble lighting fixtures, appliances, and power tools.
   - Garment sewers/assemblers join and reinforce such articles as clothing, curtains, and parachutes.
   - Soft trim assemblers install trim and upholstery in automobiles, trucks, and buses.
   - Leather goods assemblers assemble leather products such as suitcases, handbags, and wallets.
   - Communications equipment assemblers wire switchboards, telephones, and telegraph equipment.
   - Electronic component assemblers assemble televisions, radios, and stereo components such as power amplifiers, tuners, and speakers.

   You must have good math skills to do these jobs well. Most of these workers add, subtract, multiply, and divide on the job every day.

GLOSSARY

Asterisk (*): a symbol that tells you to look at the bottom of the page for the meaning, or definition, of the word.

Glossary: a list of words with their meanings.

Shop mathematics: the types of calculations typically done in a machine shop.

ANSWER SHEET

Practice Exercise A

1. T = 16 mm
   L = 25 mm
   D = 6 mm
2. T = 15 mm
   L = 23 mm
   D = 5 mm
3. T = 19 mm
   L = 34 mm
   D = 8 mm
4. T = 13 mm
   L = 26 mm
   D = 7 mm

Practice Exercise B

5. 2.75 mm
6. 4.2 mm
7. 3.0 mm
8. 6.0 mm
9. 6.5 mm
10. 11.0 mm

Practice Exercise C

11. 108 cases
12. 180 cases
13. 1,680 cases
14. 13,440 cases
15. 86,400 cases
16. 4 minutes
17. 18 minutes
18. 40 hours

Practice Exercise D

	Pieces Worked On	Gross Income
19.	595	$154.70
20.	421	239.97
21.	204	199.92
22.	709	531.75
23.	510	183.60
24.	106	83.74

Practice Exercise E

25. T = 25 mm
    L = 38 mm
    D = 11 mm
26. T = 15 mm
    L = 25 mm
    D = 6 mm
27. T = 15 mm
    L = 23 mm
    D = 5 mm
28. T = 13 mm
    L = 23 mm
    D = 5 mm

Practice Exercise F

29. 7.5
31. 11.3
32. 13
33. 16.75
34. 20.5
35. 26.5
36. 32.25

Practice Exercise G

36. 236 cases
37. 1,800 cases
38. 9,120 cases
39. 499,200 cases
40. 59 minutes
41. 80 hours
42. 2 weeks

Practice Exercise H

	Pieces Worked On	Gross Income
43.	91	$ 99.19
44.	698	237.32
45.	800	288.00
46.	930	530.10
47.	1,159	753.35